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SURBITON.—A Christmas holiday lecture for children on natural history was given at the Assembly Rooms, on Jan. 11th, by Miss Beatrice Taylor. About 120 were present. The subject was "Dwellers on Sandy Shores," and the lecture was illustrated with lantern slides. Miss Taylor spoke with evident understanding of the tastes of her audience, and the many children present were attentive and interested throughout. Pictures of sea-anemones, sea-urchins, barnacles, cockles, mussels, oysters, lobsters, etc., were recognised as old friends by those who had been at the sea-side, and who were pleased to show their knowledge in answer to Miss Taylor's questions. Details of the growth and habits of many sea-creatures were given, and practical hints as to ways of keeping them in captivity for a short time without cruelty. At the end of the lecture many children crowded round the table of specimens, and were delighted to take home with them the shells, pieces of sea-weed or moss which Miss Taylor gave them.

WINCHESTER.—At a meeting in the College Memorial Buildings, on Dec. 3rd, Mr. J. A. Fort, Winchester College, read an interesting and suggestive paper on "Heredity and Environment." He traced briefly the growth of ideas on the subject, from Lamarque and Weismann, pointing out that, although the conclusion is not undisputed, the majority of scientists are of Weismann's opinion, that acquired characteristics are not transmitted to the off-spring, and that natural selection alone, working through accidental variation is the cause of the evolution of the species. This would seem a pessimistical doctrine, when applied to the perfectibility of the human race. If none of our acquired qualities can be transmitted, every child must start where his father started, and go through the process of mental, moral, and physical training from the beginning. No efforts on the part of the present generation to improve physique or mental power, will benefit a succeeding one. But Weismann and his followers, look deeper and see that although the actual qualities are not transmitted, yet a tendency to acquire like qualities is undoubtedly hereditary. Environment, though not so important a factor as these hereditary tendencies, has without doubt a marked influence on a child's character, but there is a third something, more important than either of the foregoing, which is certainly not intended nor the product of environment, namely personality. We may say, therefore, that a child, as we have it to train and educate, is made up of three parts: hereditary tendencies, environment and individuality or personality. Education cannot alter either the environments or the hereditary capacity of an individual; all that it can do, is to develop the faculties for which a child has a hereditary capacity (intellectual training), and his personality or will-power (moral training). It is impossible to say in any case what amount of development through training may be possible, only there are certain characteristics common to all children, and these will indicate to us the general lines on which all education must work. Anger, love of pleasure, dislike of work, love of movement, dislike of sedentary pursuits, these are preserved in the child for the safety and welfare of the race, but if left unrestrained in him, he will revert to the savage, the function of education, as of civilisation, is the teaching of self-control, the training of the will.—On Saturday, Jan. 13th, Miss Taylor gave a most interesting lecture on "The Movement of Plants," illustrating her subject with lantern slides. After the lecture, Miss Taylor shewed the children several specimens under the microscope, and also shewed them how to mount their own slides, in which they were much interested.

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THE INFLUENCE OF HEREDITY & ENVIRONMENT UPON THE GROWTH & DEVELOPMENT OF AN INDIVIDUAL.*

By J. A. FORT.

MY subject was given to me by a member of the committee, and in a rash moment I undertook to write about it. I need not say that I have found my task only more and more difficult as I thought more and more about it, and that I only carry out my promise to read a paper—firstly, because almost any paper will serve as the basis for a discussion, and, secondly, because I think those who are here really want rather to consider how evolutionist doctrines should affect their treatment of their children and their scheme of education, than to hear a theoretical enquiry into the scientific bases of those doctrines.

I must, however, first say a word upon one theoretical question involved in the doctrine of heredity. There are two possible views as to the nature of heredity: the one that parents can transmit only those qualities which they themselves inherited, the other that they can transmit also the characteristics which they have acquired by the use of their faculties and powers. According to the former view, Sandow's son, if he has one, will be likely to inherit from him only the physique with which Sandow began life; according to the second, he will be likely to inherit not only that, but all or some of the additional strength and skill which Sandow has acquired by the steady training of his muscles. At first sight, it seems of very great importance which of these views we accept as the true one. If parents can transmit, roughly speaking, only those qualities which they themselves inherited, then there must be a tolerably definite limit to the possible development of the individual, and therefore to the progress of the race. If on the contrary, parents can transmit their acquired faculties and characteristics, then at first sight it seems hardly possible to assign any limits to the perfectibility of the human race, and even for each successive generation it seems that there must be a vast amount of progress or advancement possible.

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* Paper read to the Winchester branch of the P.N.E.U.

I cannot say that either of these two theories has yet been fully established, but I believe it is the case that at least in England and Germany it is now held by most men of science, that the first of the two is the right one, and that acquired characteristics are not transmitted to the offspring. Meantime, the position with regard to the question seems to be as follows:—Lamarck, writing between 1815 and 1822, and hinting at some of the doctrines which Darwin afterwards demonstrated with so much greater clearness, and established by such a mass of observation, formulated the doctrine that "gains and losses due to use and disuse are transmitted from parents to offspring," and he explained the difference existing between different individuals and different species of animals by means of this principle. He thought, for instance, that the long neck of the giraffe arose by constant stretching (on the part of successive generations of giraffes) after the leaves of trees, and that the web between the toes of a water-bird's foot arose by the constant extension of the toes (on the part of successive generations of water-birds). Lamarck's opinions are still held by many in France, and have even been made the basis for still further theories of the kind in America. There are, indeed, certain outstanding facts, especially the results of certain experiments made on guinea-pigs by Sequard-Brown, which are more easily explained on this principle than on any other, and Darwin himself accepted Lamarck's principle when he first published the *Origin of Species*. In later years he was more doubtful on the point, holding rather that if acquired characteristics might be transmitted, the effects of such

transmission was unimportant, the results of variation and natural selection all-important in the formation of the characteristics of individuals and species. Wallace, who independently thought out so much of that body of doctrines which are chiefly associated with Darwin's name, held throughout that acquired characteristics are not transmitted, and he points out one fact which at any rate puts the whole question on a totally different footing; even if the cases quoted by Lamarck showed that gains and losses due to use and disuse are transmitted from parents to offspring, it would still be true that the variations so produced are neither greater nor more rapid in their operation than those produced by natural selection alone; if, that is to say, Sandow can transmit to his son some of his acquired chest-development, he does not transmit the whole of it, but only a small fraction of it, and this fractional amount is found on examination to be no greater than the amount of variation which Darwin has shown to arise through natural variation and selection. Wallace's argument, briefly summarised is as follows:—In the case of certain tame pigeons which fly but little, and in which, therefore, we can observe the effects of disuse, it is found that in the whole course of domestication, a period no doubt of four or five thousand years, the breast-bone has been diminished by only one-seventh or one-eighth of its entire length; but "the fortuitous variation of every organ usually amounts to one-tenth and often to one-sixth of the average dimensions, that is the fortuitous variation in one generation," may be, "as great as the cumulative effects of disuse in one thousand generations." It is fair to assume that if this is true of the loss held by Lamarck to result from disuse, the same is true of the gains which could result from use. And we must, therefore, hold that even if Lamarck is right in his view, the pace of evolution is not increased in any way. The result therefore is, however unsatisfactory it may seem to some, that whichever theory may be the true one perfection is equally distant from the human race. But Weismann's work has really made it almost certain that the view which prevails in Germany and England is the right one, and that acquired characteristics cannot be transmitted to offspring. His position is a strong one, for he is the only thinker who has formulated any theory which is at all probable as to the mechanism of heredity, and if his theory is right, or even approximately right, parents certainly transmit—subject to the laws of variations which Darwin demonstrated—only those qualities which they themselves inherited. The perfectibility of the human race then is a dream, the present generation are not on the whole any better than their fathers, their descendants are not likely to be much stronger, wiser, or better than themselves.

But let us look at the matter a little more closely and in particular let us try to understand further what Weismann's doctrine about heredity is. It certainly seems as though children in many cases are not only born with the same qualities (of health, strength, temperament) with which their parents were presumably born, but acquire the same characteristics that their parents acquired—the sons of painters become good painters, the sons of those engaged in teaching obtain scholarships more than others, the Darwins have been distinguished men of science for three generations, the House of Lords is not an effete body of legislators, the kings of England have been a singularly capable line of rulers. Indeed, when the matter is looked into, it is found that it is not the facts about which the two schools of thought dispute, but only the explanation of them. If a parent's acquired characteristics cannot be inherited, they are very often acquired—in less or greater degree—by the offspring. The full theory of Weismann therefore in this matter, and, I think, the generally accepted theory about it is, that, though acquired characteristics cannot actually be transmitted, a tendency to acquire the same quality, a constitution fitted to acquire approximately the same quality, not only can be, but, speaking generally, is commonly transmitted from generation to generation. Ability seems to be hereditary in certain families; though consumption is certainly not hereditary, a tendency to develop consumption appears to be hereditary in certain families; the system prevailing in the East under which a son commonly follows his father's trade is not so unreasonable as it seems at first; presidents elected by vote have not proved so much abler as a class than the kings who have ruled contemporaneously with them. Talent or virtue, it is

true cannot be expected to develop, as some past enthusiasts hoped, by an arithmetic progression in succeeding generations, but a particular talent or a particular virtue can be developed under stress of circumstances beyond any point which may be taken as the starting point in the observation, as skill in painting and the kindred arts certainly was developed in the time of the Renaissance: and though virtue or a talent may retrogress as well as progress, there are forces in nature which must always prevent continued retrogression where that is of any disadvantage to the individual or the race.

The theory then which must in my judgment underlie any system of education is "that certain qualities (mental and physical) are congenital in every individual, but that in spite of that fact (indeed as part of that fact) each individual has a capacity to develop or acquire special characteristics under the circumstances of life, *i.e.*, through the environment of the individual."

It is from an instinctive perception of these truths that every parent starts from the beginning to train his or her child; it is on the assumption of this principle that the whole practice or art of education is based and founded. If anyone should be disappointed that the necessity of parental care should rest upon an assumption only, I would point out that every great belief rests ultimately only upon an assumption, and that this assumption is amply justified by Nature's teaching, since not only man, but *all* the higher orders of animals and birds are distinguished from the lower forms by the care which they bestow upon their offspring. The practice of education and care of children rests upon as firm a basis as any other practice in the whole world.

What then are the unalterable characteristics in man's nature? What does environment do for or against him? What characteristics can man acquire? There is beyond doubt no science of education of such a kind that the answers to these questions may be deduced from it with certainty and accuracy; the answer can only come through the vaguer but well-tried methods of observation and experiment.

Now with regard to the first question, it seems to me far easier to show that there are some unalterable characteristics in each individual, congenital capacities which are fixed for each, than to say exactly what these are. It seems to me clear that there are such things; everyone finds that there are some things which he cannot do; everyone at some time of his life has his ideal, and yet no one—not even the best of men, as biography after biography shows—models himself exactly according to the pattern of that ideal; the case is the same as between parents and children—every parent has a clear idea what he or she would like the eldest child to be when it grows up—yet, however hard both parent and child try, however much both work together, the child grows up to be in some respects different from the ideal; again, there are family traits which tend to reproduce themselves among relations, not only physical likenesses, and similar habits of thought, but little tricks of manner and gesture, which are not only unconsciously reproduced, but which often reproduce themselves in branches of a family that have lived apart from each other, or which even come out in a child who has lost the parent from which his tricks or habits seem to come. The same is true of race-characteristics, and the old doctrine holds good to a wonderful extent, that in educational matters there are strangely close analogies between the life of the individual and that of the race. I need not illustrate this point in detail, but I would submit that it is the case, since everyone has his idea what the typical Frenchman, German, and American are like, and so with still larger families, Teuton, Slav and Gaul—even Oriental and Occidental.

No one can tell in the case of a particular child what qualities lie latent in it. The keenest observers of all—the parents—are often disappointed in their expectations: the professional observers—the schoolmasters—are often unduly pessimistic in their judgments. Observation is easier on the physical side, and on the physical side it can readily be seen that prophecy in the matter is very uncertain; for some families reach their full height at a lesser, others at a greater age; delicate children grow up strong; thin people become fat; even strong people lose their health. All these phenomena repeat themselves in the mental and moral parts of human nature. Always to hope and always to fear for the young is the only proper attitude of mind for masters and parents.

But there are some qualities so nearly common to all the young that, though they vary in degree in different cases, they concern all those who have the care of any children. I think that every child that is born into the world has the quality of anger; I am sure that everyone who is born into the world has to learn self-control with regard to every faculty or passion which he develops as he goes on growing. Every child has a love of pleasure, with a disinclination to do unpleasant things; every child has a love of physical activity with a disinclination at first for sedentary pursuits; every child has a love of sweets. Now it is no good being just vexed with our children for having these capacities and tastes; if the children are going to be there, they are going to have these characteristics. Indeed, I go further, and hold that, if, as I think is the case, these things are always present, they are there just because they are either inevitable conditions of our human nature, or are of definite use for the preservation of the individual or the species. The early want of self-control is clearly inevitable in our composite human nature; an individual suddenly finds a new power growing within him. How can he know the proper limits of its use at first? Nay more, till it has become so far a part of his nature that it is co-ordinated with the whole, he cannot absolutely control it. It is an old observation that if a boy cares at all for anything—whether it is a good or a bad thing—he generally cares for it too much; the reason is obvious, when a special quality—whether it is in itself good or bad—is growing, it is insistent, it continually forces itself on the attention; it is only at a later stage that the whole mechanism is complete, that that quality is co-ordinated with others in such a way that it is held in check by them, or is coupled-up with, linked on to, the will in such a way that it is controlled by it.

Take again the case of anger: why is it always present in every child and to some extent in every man? for who would think of going through the world without retaining his capacity for righteous wrath? It is there partly because it is still necessary—as long as man or woman may have to defend themselves in struggle or combat, it will always be necessary—for the protection of the individual and the race. It is there in excessive degree, because the life of each individual is to some extent an epitome of the history of the whole race:

when our ancestors were savages, they had to fight; and anger to use at need is a necessary ingredient in the fighting qualities; the races which did not have it have long been struck off the list of living things; the poor little child of to-day has in it some of the anger of the woad-stained Briton, possibly even some of the anger of a Berserk ancestor; of course it is too much for modern use in time of peace; but life is not all peace and anger must needs be there; it would be well for the Chinaman if he had not lost so much of it during his too many centuries of civilisation.

It is much the same with the other things I mentioned. The child loves physical activity more than sedentary occupation, because the higher forms of intellect were evolved later than the rest of the body; the body of the child grows up before its mind; the exercise is good for it as well as easy for it; we must be contented if the mind grows up at length. So too with pleasure: Diogenes held no doubt rightly that it was the hardest enemy of all those which he had defeated. The love of pleasure can be easily pushed to excess, and a person who cares too much for pleasure is wholly useless. But in itself the thing is good: no doubt H. Spencer was right when he laid down that an individual is happy when he is in harmony with his environment. Things are pleasant when they are suited to our nature as it is at any given moment; it is true that we have to get rid of the lower pleasures and find higher ones. But in itself the love of pleasure is not only a natural instinct, it is an actual teacher of what is to be sought, as pain is a rough teacher of what is to be avoided. Ultimately, I know the child has to become a member of a civilised community, and learn to live morally and thoughtfully in it: it will have to give up the pleasures which would unfit it for that work, it must learn to get pleasure from the things that fit it for that kind of life, but it can not do this all at once. It is only slowly that anyone can learn the better pleasures, the best pleasures of all come late in life.

With regard to other qualities and the limitations of their children, parents can learn them only by observing what they are. Nearly all have roughly the same qualities, physical, mental, moral, but different individuals have them in very varying forms and very varying degrees. All boys can do some athletics fairly well, but no two are exactly equal in one pursuit; all boys can in their adaptive years learn something of any subject, but no two boys advance at exactly the same pace or within the same limits in any subject whatever it may be; all people recognise roughly the same qualities as moral qualities, but they attach very different importance to different qualities, and they admire very different forms of the same moral quality, *e.g.*, of courage. When one reflects how rare a thing high mathematical power is, what special gifts are involved in high poetical or mechanical inventive genius, it is clear that there are limits to our mental powers which are fixed by Nature and which cannot be moved or altered by any course of training.

Now at this point I must try to find some answer to the second problem which I suggested to you, and I must say a few words about the effects of environment upon the character of the creature, who is first a child and then a man. But, here again I must protest against any attempt to lay down rigidly what the limits are within which environment, *i.e.*, the circumstances of life, can affect a man. That William Pitt's career could not have been what it was if he had not been Lord Chatham's son, living constantly under the influence of that great genius, and with an early entrance into political life open to him, seems to me to be self-evident. But, I can say about environment only what I said about heredity, though there certainly are important consequences from the one as from the other, no one can say within what limits, and to what extent each has made the man.

I will pass on to state briefly what in my judgment is the only practical way to view this matter, and in doing so I shall state what in my judgment is the only real business of education. I fear that this is all I can do in the way of taking up a definite position with regard to the difficult subject of which I have undertaken to write.

I think that the man at his full growth, when he has reached the full extent of all his powers, is the result, not of two but of three main forces. The nature which he inherited from his parents, his environment, *i.e.*, the external circumstances of his life, and a third something, which is often called his character or his personality, the power of choice or will, which, whatever the real nature of that thing may be—and philosophy speaks with a very uncertain voice upon the subject—everyone certainly does possess, the power, that is, which all have to make to some extent the circumstances of their lives, to make to some extent their own environment. This power of will must be, I suppose, one of the products of heredity, it is certainly as a rule dependent to some extent upon environment, but all that I care to insist upon is that it does exist, that it is not a fiction, that on the contrary, it is a very real force indeed; a man possesses the power to choose between two alternatives, and he thus possesses the power to make to some extent the circumstances of his own life. In my judgment, this force must be considered as potent as either of the other two forces to which I have referred in the production of the full-grown man. The usual story of a man's life is that he finds himself in early manhood in a certain position, and with certain powers; that both difficulties and opportunities soon present themselves: if he faces the first difficulty or seizes the first opportunity, he is at once a different man from what he was before; he has gained further powers, and he is ready for higher trials. Every great man's life, every active man's life is the result not only of his congenital nature and the circumstances made for him, but of the use he made of both; it is the result largely of things done which he might have left undone, of efforts made which he might have left unmade. It is for this reason that moral teaching and moral training mean nothing except the training of the will, and teaching about it.

And the whole of education—in however wide a sense the term may be used—is again concerned with a part only of all that concerns man. Education has nothing to do with congenital qualities and powers, on which it can have no influence whatever. Education has to accept the circumstances of life that it finds in every case. What it *is* concerned with, is the acquiring of characteristics, physical, moral, and intellectual, and the acquiring of faculties in the same three directions. If Sandow uses heavy dumb-bells and ingenious exercises, he will develop his muscles—no one knows how much: there is no other art of education: *à force de forger on devient forgeron* is the only method of training not only for smiths, not only

for all craftsmen, but for everyone who has to do any kind of work whatever. The whole science of education—if it exists—is nothing but the determining, first, what the result to be aimed at is to be; and, secondly, what exercises are most appropriate for producing that result.

It is mere waste of time to consider which of the three great forces of which I have been speaking have most to do with the final result, the moulding of the fully developed man. The full truth is known only to a man's maker, it is not known even to the man himself. I can best explain my view of the matter by a simple simile; when an explosion of gunpowder takes place, neither the sulphur, nor the charcoal, nor the saltpetre in it is the cause of the explosion, nor is any of the three the chief cause of it, the explosion is the result of all three in combination: it is so with the explosions which most of us call acts and psychologists reactions in the human organism. The great poet expressed a profound truth in a jesting form when he wrote, "some men are born great (heredity), some achieve greatness (will), some have greatness thrust upon them (environment)."